

Supplemental Materials 1: Sampling Plot Selection and Screening

Selecting and establishing sampling units that are representative of an established sampling frame or target population onto a landscape can be a time consuming and challenging effort. To make the process for the 2016 monarch monitoring trial as time and travel efficient as possible, potential sites and plot areas were screened and evaluated before sending data collectors into the field to establish plots on the ground. These materials describe how sampling units were selected and plots checked for adequacy using spatial data and a GIS.

For the 2016 monitoring trial two Generalized Random Tessellation Stratified (GRTS) sample locations were drawn by Wayne Thogmartin (USGS, La Crosse, WI) for each of 3 participating National Wildlife Refuges (Washita, Neal Smith, Waubesa) and vicinity (6 sets of locations in total). Within each pair, one draw was done on refuge lands and a second GRTS draw was done on refuge and surrounding private lands within a 60-mile radius from the refuge. These lists were long enough to provide refuges with many options for choosing sites on and off refuge lands. However, the time to work through the private land sites and get access was limited resulting in locating or accepting whatever sites were available (independent of the draw) for sampling CRP, agricultural fields with crops, and unprotected grasslands.

Sites provided in the GRTS list are stratified as follows: 1) Grasslands, 2) ROW, 3) Ag/CRP and 4) Urban/Suburban. During the monitoring trial, we will break the 'Grasslands' category down into protected and unprotected grasslands. Also note that we will break the 'Ag/CRP' category down and visit separate Ag (cultivated) and CRP sites. For legal reasons, Wayne could not separate and show locations on CRP lands and had to leave them combined with the Agricultural lands. Our settled upon sampling strata resulted in 5 plot types: Protected Grasslands (PRG), Roadsides (RDS), Unprotected Grasslands (UPG), Agriculture with crops (AGC), and lands enrolled in the Conservation Reserve Program (CRP).

Each listed GRTS draw location represents a center point for a 300 m x 300 m sample unit. This area is fairly large for sampling but we did not have to sample the entire square. Rather, we eventually settled on a rectangular plot area of 75 m x 300 m, large enough to accommodate sampling for plants and monarchs. However, because this smaller plot area needed to represent the composition of the entire sample unit, we needed to decide how to place the rectangular plot on the landscape. Within the larger sample unit, the rectangular plot could be arranged in 8 parcels total, 4 with a long-axis in a north to south orientation and another 4 in a west to east orientation (Figure SM-1.1). To choose an orientation and location for the rectangular plot within the sample unit, Richard Easterbrook conducted a spatial analysis using Excel calculations for possible plot coordinates and a GIS for determining two values for each possible plot: 1) the percent of homogeneity of plot area relative to the parent sampling stratum, and 2) the range of elevation (m) within the plot (which is presumed to be correlated with plant diversity). For example, if the stratum is "grassland," the plot should be placed such that it minimizes inclusion of lands that are not grasslands (e.g. woods, wetland, etc.). For each GRTS draw location, data on percent homogeneity and elevation range was reviewed for the 8 possible rectangular plot positions. To be considered for sampling, a single plot orientation had to have 75% or more of its area classified the same as the GRTS point location. If none of the 8 plots meet this criterion, the GRTS location was dropped from consideration. The most suitable plot

would be one with 100% of its area that was classified with the same parent stratum as the GRTS point. If 2 or more of the 8 possible plots for a single sample unit showed the same level of homogeneity then the plot with the maximum elevation range was added to a set of possible sampling plots that would undergo the second phase of screening (for access, water traps, ground truthing, and accuracy of vegetation described by year's old remote sensing data).

This first phase of screening only pertained to rectangular plots that could be used in grasslands or potentially agricultural fields. It did not apply to roadside plots, which required a different approach discussed below.

Pre-screening Results for Grassland Plots—Approximately, the first 20 GRTS draw sites for each stratum (except CRP which was still buried among the agricultural sites) were evaluated. Many of the on refuge GRTS draw points had one or more plot orientations that met the criteria. Washita NWR had more AGC plots on the refuge than the other two refuges and all three had several suitable PRG plots to ground truth (Table SM-1.1; see also spreadsheet file [MMT Plot Orientation Data_ver3.xlsx](#)). The spreadsheet file can be consulted to see the relationship between the plot label, homogeneity and elevation range values, and the GRTS draw identifier. The GRTS draw point ID is the second to last number in the 5 parted character string in the Site ID column.

Additional locations were examined for Waubay Wetland Management District beyond the refuge-proper boundaries and 3 PRG plots were found following the same evaluation process. Secondary screening did reduce a number of sites before enough sites existed to conduct rapid assessments (RADs) for about 10 PRG and RDS plots. Data from the rapid assessment of milkweed numbers would be used to pick a final set of 3 to 5 plots for intensive measurement and implementation of SOPs 1—4.

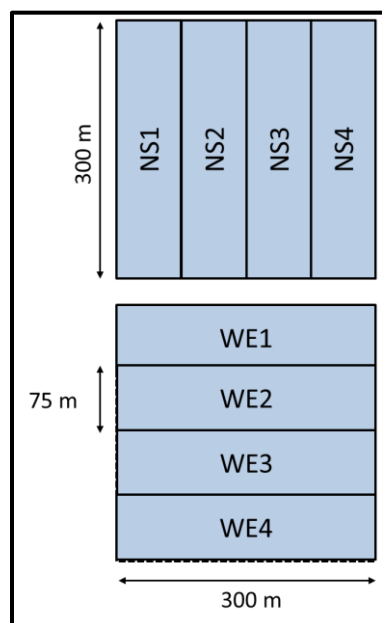


Figure SM-1.1. Eight possible orientations for open field plots (75 m x 300 m) within a 9 ha sample unit for the Monarch Monitoring Trial. Plot orientation for lay out in the field was selected using highest homogeneity of plot area of the sample draw stratum over 75%. If several possible orientations had similar high homogeneity values, then the orientation that yielded the area with the highest range in elevation was recommended. NS1—NS4 represent 4 vertical options and WE1—WE4 represent 4 horizontal options of plot placement which relate to VERT or HORZ values in the Site ID of Table SM1.1 below.

Table SM-1.1. Best plot orientations and suitable sites for sampling monarchs and plants at three National Wildlife Refuges, based on an initial GRTS sample draw on lands within and around the refuge boundaries. Highlighted value in the first row (006) shows the GRTS draw id number (unique for a given draw list). PlotorSiteID value includes refuge acronym (NLS—Neal Smith, WYB—Waubay, WST—Washita); draw for on the NWR or OUT of the refuge boundaries; sample draw stratum classification of the draw point location; elevation range in m and percent homogeneity of plot area relative to the sample draw stratum.

Plot Label	PlotorSiteID	SDStratumPt	ElevRange_m	SDStratumPct
AGR01	NLS-NWR-VERT-006-0004	Agriculture	11.41	100.0
AGR02	NLS-NWR-HORZ-029-0025	Agriculture	8.03	100.0
AGR03	NLS-NWR-HORZ-034-0071	Agriculture	12.32	98.4
AGR04	NLS-NWR-HORZ-045-0036	Agriculture	10.36	100.0
PRG01	NLS-NWR-HORZ-001-0119	Grassland	14.13	100.0
PRG02	NLS-NWR-VERT-002-0098	Grassland	10.82	99.8
PRG03	NLS-NWR-VERT-003-0143	Grassland	10.92	86.0
PRG04	NLS-NWR-VERT-007-0223	Grassland	11.72	100.0
PRG05	NLS-NWR-VERT-009-0115	Grassland	14.80	100.0
PRG06	NLS-NWR-VERT-014-0169	Grassland	12.32	100.0
PRG07	NLS-NWR-HORZ-017-0118	Grassland	16.04	100.0
PRG08	NLS-NWR-HORZ-018-0112	Grassland	9.50	100.0
PRG09	NLS-NWR-VERT-019-0197	Grassland	10.51	96.7
PRG10	NLS-NWR-VERT-021-0069	Grassland	6.40	100.0
PRG11	NLS-NWR-VERT-022-0243	Grassland	8.84	100.0
PRG12	NLS-NWR-VERT-030-0188	Grassland	8.56	98.6
PRG13	NLS-NWR-HORZ-037-0100	Grassland	6.80	100.0
PRG14	NLS-NWR-HORZ-042-0166	Grassland	20.14	100.0
PRG15	NLS-NWR-HORZ-044-0160	Grassland	13.10	78.5
PRG16	NLS-NWR-HORZ-046-0150	Grassland	12.04	100.0
PRG17	NLS-NWR-VERT-049-0041	Grassland	8.45	99.6
PRG18	NLS-NWR-HORZ-050-0024	Grassland	10.94	98.3
PRG19	NLS-NWR-HORZ-051-0199	Grassland	17.07	100.0
PRG20	NLS-NWR-VERT-053-0104	Grassland	7.02	100.0
UPG01	NLS-OUT-HORZ-001-0762	Grassland	14.36	100.0
UPG02	NLS-OUT-HORZ-002-1375	Grassland	12.13	97.4
UPG03	NLS-OUT-VERT-005-0262	Grassland	15.78	85.8
UPG04	NLS-OUT-VERT-009-0176	Grassland	11.65	92.1
UPG05	NLS-OUT-HORZ-013-0856	Grassland	12.82	100.0
UPG06	NLS-OUT-HORZ-024-0777	Grassland	11.78	95.8
UPG07	NLS-OUT-VERT-036-0370	Grassland	10.52	78.3
UPG08	NLS-OUT-HORZ-041-0870	Grassland	15.01	100.0
UPG09	NLS-OUT-VERT-042-1597	Grassland	23.75	83.9
UPG10	NLS-OUT-HORZ-043-0203	Grassland	10.73	77.3
UPG11	NLS-OUT-VERT-047-0184	Grassland	12.76	91.1
UPG12	NLS-OUT-HORZ-049-1497	Grassland	21.35	100.0

UPG13	NLS-OUT-HORZ-050-1727	Grassland	17.03	100.0
UPG14	NLS-OUT-VERT-052-1302	Grassland	35.16	77.3
UPG15	NLS-OUT-VERT-053-0367	Grassland	7.25	100.0
UPG16	NLS-OUT-HORZ-055-1699	Grassland	17.52	98.5
UPG17	NLS-OUT-HORZ-056-0698	Grassland	7.18	96.9
UPG18	NLS-OUT-VERT-059-0449	Grassland	14.94	100.0
UPG19	NLS-OUT-HORZ-060-0741	Grassland	16.11	83.1
AGR01	NLS-NWR-VERT-006-0004	Agriculture	11.41	11.4
AGR02	NLS-NWR-HORZ-029-0025	Agriculture	8.03	8.0
AGR03	NLS-NWR-HORZ-034-0071	Agriculture	12.32	12.3
AGR04	NLS-NWR-HORZ-045-0036	Agriculture	10.36	10.4
AGR05	NLS-OUT-HORZ-003-1879	Agriculture	11.12	80.1
AGR06	NLS-OUT-HORZ-004-0011	Agriculture	16.07	86.2
AGR07	NLS-OUT-HORZ-015-0515	Agriculture	8.35	100.0
AGR08	NLS-OUT-VERT-019-1852	Agriculture	3.69	100.0
AGR09	NLS-OUT-HORZ-020-0578	Agriculture	6.73	100.0
AGR10	NLS-OUT-VERT-021-0381	Agriculture	10.03	78.6
AGR11	NLS-OUT-HORZ-022-1693	Agriculture	3.68	100.0
AGR12	NLS-OUT-HORZ-031-0272	Agriculture	7.02	100.0
AGR13	NLS-OUT-HORZ-033-1481	Agriculture	12.48	89.1
AGR14	NLS-OUT-HORZ-038-2253	Agriculture	5.99	100.0
AGR15	NLS-OUT-HORZ-040-0767	Agriculture	9.24	100.0
AGR16	NLS-OUT-HORZ-045-1141	Agriculture	4.36	97.8
AGR17	NLS-OUT-HORZ-054-2331	Agriculture	2.51	98.8
AGR18	NLS-OUT-VERT-062-1708	Agriculture	15.31	98.2
AGR19	NLS-OUT-HORZ-064-1182	Agriculture	11.69	99.4
AGR20	NLS-OUT-VERT-065-0847	Agriculture	15.19	100.0
AGR22	NLS-OUT-VERT-067-2140	Agriculture	14.45	100.0
AGR23	NLS-OUT-HORZ-070-2164	Agriculture	2.87	100.0
AGR24	NLS-OUT-HORZ-076-1069	Agriculture	23.25	90.5
AGR25	NLS-OUT-HORZ-077-0747	Agriculture	9.96	80.9
AGR01	WBY-NWR-HORZ--010-0034	Agriculture	5.61	82.6
PRG01	WBY-NWR-VERT-004-0047	Grassland	3.72	82.0
PRG02	WBY-NWR-VERT-005-0007	Grassland	4.50	100.0
PRG03	WBY-NWR-VERT-008-0085	Grassland	6.84	91.6
PRG04	WBY-NWR-VERT-012-0052	Grassland	7.05	92.1
PRG05	WBY-NWR-VERT-015-0080	Grassland	10.49	80.8
PRG06	WBY-NWR-VERT-021-0040	Grassland	5.66	92.0
PRG07	WBY-NWR-VERT-022-0049	Grassland	10.79	100.0
PRG08	WBY-NWR-HORZ--024-0096	Grassland	3.68	88.7
PRG09	WBY-NWR-HORZ--035-0092	Grassland	12.97	96.0
PRG10	WBY-OUT-VERT-004-1325	Grassland	9.20	100.0
PRG11	WBY-OUT-HORZ-011-1645	Grassland	7.36	100.0
PRG12	WBY-OUT-VERT-015-1959	Grassland	6.70	100.0

PRG13	WBY-OUT-VERT-020-1146	Grassland	9.25	100.0
PRG14	WBY-OUT-HORZ-026-0500	Grassland	4.88	100.0
PRG15	WBY-OUT-HORZ-032-2380	Grassland	0.37	100.0
PRG16	WBY-OUT-VERT-036-0747	Grassland	0.98	99.6
UPG01	WBY-OUT-HORZ-002-1826	Grassland	26.22	100.0
UPG02	WBY-OUT-HORZ-003-0190	Grassland	4.75	100.0
UPG03	WBY-OUT-HORZ-006-1454	Grassland	12.49	90.1
UPG04	WBY-OUT-HORZ-008-0740	Grassland	15.78	100.0
UPG04	WBY-OUT-HORZ-010-0216	Grassland	7.50	100.0
UPG06	WBY-OUT-VERT-017-0790	Grassland	8.15	100.0
UPG07	WBY-OUT-HORZ-022-0316	Grassland	4.70	100.0
UPG08	WBY-OUT-VERT-024-0989	Grassland	5.43	100.0
UPG09	WBY-OUT-HORZ-029-1977	Grassland	13.83	100.0
UPG10	WBY-OUT-VERT-035-0289	Grassland	3.85	94.6
UPG11	WBY-OUT-VERT-038-0699	Grassland	15.35	100.0
UPG12	WBY-OUT-HORZ-041-0751	Grassland	0.74	100.0
UPG13	WBY-OUT-HORZ-045-1800	Grassland	12.85	100.0
AGR01	WBY-NWR-HORZ--010-0034	Agriculture	5.61	82.6
AGR02	WBY-OUT-VERT-001-1026	Agriculture	10.84	100.0
AGR03	WBY-OUT-HORZ-005-1171	Agriculture	3.36	100.0
AGR04	WBY-OUT-HORZ-014-0717	Agriculture	0.01	100.0
AGR05	WBY-OUT-HORZ-019-0662	Agriculture	1.01	100.0
AGR06	WBY-OUT-HORZ-040-1528	Agriculture	1.13	80.1
AGR07	WBY-OUT-HORZ-043-2209	Agriculture	2.32	100.0
AGR08	WBY-OUT-HORZ-046-0730	Agriculture	4.73	75.0
AGR09	WBY-OUT-HORZ-047-1153	Agriculture	1.86	100.0
AGR10	WBY-OUT-VERT-049-0712	Agriculture	2.91	100.0
AGR11	WBY-OUT-HORZ-050-1656	Agriculture	1.38	100.0
AGR12	WBY-OUT-VERT-060-1209	Agriculture	4.41	100.0
AGR13	WBY-OUT-HORZ-065-0908	Agriculture	0.97	100.0
AGR14	WBY-OUT-VERT-067-0256	Agriculture	4.05	100.0
AGR15	WBY-OUT-VERT-070-1781	Agriculture	1.34	99.0
AGR16	WBY-OUT-VERT-073-1492	Agriculture	2.57	99.3
AGR17	WBY-OUT-HORZ-079-1969	Agriculture	1.46	100.0
AGR18	WBY-OUT-VERT-081-0847	Agriculture	2.40	77.6
AGR19	WBY-OUT-VERT-095-1515	Agriculture	0.82	94.0
AGR20	WBY-OUT-HORZ-098-1851	Agriculture	1.25	75.0
AGR21	WBY-OUT-HORZ-099-0295	Agriculture	4.10	100.0
AGR02	WST-NWR-HORZ-003-0052	Agriculture	2.15	100.0
AGR05	WST-NWR-HORZ-014-0099	Agriculture	1.38	100.0
AGR06	WST-NWR-HORZ-019-0089	Agriculture	4.23	97.4
AGR07	WST-NWR-HORZ-021-0115	Agriculture	1.92	100.0
PRG02	WST-NWR-HORZ-004-0016	Grassland	9.07	96.9
PRG03	WST-NWR-HORZ-007-0038	Grassland	7.98	96.3


PRG04	WST-NWR-HORZ-008-0008	Grassland	11.56	100.0
PRG10	WST-NWR-VERT-018-0057	Grassland	6.65	100.0
PRG13	WST-NWR-VERT-023-0071	Grassland	13.54	100.0
PRG14	WST-NWR-VERT-026-0017	Grassland	9.88	100.0
PRG15	WST-NWR-VERT-028-0072	Grassland	1.42	75.8
PRG15	WST-NWR-HORZ-030-0046	Grassland	9.86	100.0
PRG16	WST-NWR-HORZ-031-0081	Grassland	2.67	100.0
PRG17	WST-NWR-VERT-035-0021	Grassland	8.23	100.0
UPG01	WST-OUT-VERT-001-0043	Grassland	0.84	79.8
UPG02	WST-OUT-VERT-003-2388	Grassland	2.73	90.0
UPG03	WST-OUT-HORZ-004-0763	Grassland	11.99	100.0
UPG04	WST-OUT-VERT-006-1004	Grassland	7.50	100.0
UPG05	WST-OUT-HORZ-007-1458	Grassland	0.31	100.0
UPG06	WST-OUT-HORZ-008-1880	Grassland	7.89	100.0
UPG07	WST-OUT-VERT-009-0682	Grassland	6.78	100.0
UPG08	WST-OUT-VERT-010-1634	Grassland	7.23	78.4
UPG09	WST-OUT-HORZ-013-1347	Grassland	8.74	100.0
UPG10	WST-OUT-HORZ-020-0551	Grassland	8.25	100.0
UPG11	WST-OUT-VERT-021-0151	Grassland	15.25	79.4
UPG12	WST-OUT-HORZ-022-0780	Grassland	6.85	92.1
UPG13	WST-OUT-VERT-023-1501	Grassland	10.20	100.0
UPG14	WST-OUT-VERT-024-1627	Grassland	4.32	100.0
UPG15	WST-OUT-HORZ-027-2089	Grassland	7.36	100.0
UPG16	WST-OUT-HORZ-031-0942	Grassland	2.50	100.0
UPG17	WST-OUT-VERT-036-0818	Grassland	7.76	100.0
UPG18	WST-OUT-HORZ-037-0213	Grassland	5.07	97.8
UPG19	WST-OUT-HORZ-038-1217	Grassland	19.24	99.2
UPG20	WST-OUT-VERT-039-1828	Grassland	26.07	100.0
AGR01	WST-NWR-VERT-001-0130	Agriculture	0.39	100.0
AGR02	WST-NWR-HORZ-003-0052	Agriculture	2.15	100.0
AGR03	WST-NWR-VERT-005-0126	Agriculture	1.24	100.0
AGR04	WST-NWR-VERT-009-0103	Agriculture	4.15	100.0
AGR05	WST-NWR-HORZ-014-0099	Agriculture	1.38	100.0
AGR06	WST-NWR-HORZ-019-0089	Agriculture	4.23	97.4
AGR07	WST-NWR-HORZ-021-0115	Agriculture	1.92	100.0
AGR08	WST-NWR-HORZ-027-0109	Agriculture	0.38	100.0
AGR09	WST-NWR-VERT-032-0086	Agriculture	1.56	98.0
AGR10	WST-NWR-VERT-034-0107	Agriculture	2.46	100.0
AGR11	WST-OUT-VERT-002-0071	Agriculture	3.01	100.0
AGR12	WST-OUT-HORZ-011-1923	Agriculture	8.17	100.0
AGR13	WST-OUT-VERT-025-0953	Agriculture	6.32	86.4
AGR14	WST-OUT-HORZ-028-0246	Agriculture	3.70	81.7
AGR15	WST-OUT-VERT-034-0706	Agriculture	2.80	100.0
AGR16	WST-OUT-HORZ-041-1073	Agriculture	2.58	100.0

AGR17	WST-OUT-VERT-048-1193	Agriculture	4.55	80.6
AGR18	WST-OUT-HORZ-053-0692	Agriculture	5.26	100.0
AGR19	WST-OUT-HORZ-060-1185	Agriculture	2.94	98.0
AGR20	WST-OUT-VERT-064-1808	Agriculture	1.30	100.0
AGR21	WST-OUT-HORZ-066-0200	Agriculture	4.03	100.0
AGR22	WST-OUT-VERT-069-0074	Agriculture	4.18	90.2
AGR23	WST-OUT-HORZ-072-1940	Agriculture	4.53	100.0
AGR24	WST-OUT-VERT-074-1577	Agriculture	5.45	100.0
AGR25	WST-OUT-VERT-077-1360	Agriculture	1.00	100.0
AGR26	WST-OUT-HORZ-080-1274	Agriculture	1.76	100.0
AGR27	WST-OUT-HORZ-089-0982	Agriculture	5.66	97.3
AGR28	WST-OUT-HORZ-091-2201	Agriculture	1.55	94.9
AGR29	WST-OUT-VERT-097-0383	Agriculture	5.13	100.0
AGR30	WST-OUT-HORZ-101-0128	Agriculture	3.11	99.5

Screening and Mapping Plots or Transects Prior to Establishment

Note: The following instructions are intended for use while working on a desktop version of ArcMap, not the Collector interface while working on a PAD. Although transect beginning and end points can be pre-measured and placed onto the map while using the PAD, it is strongly suggested that the desktop version of ArcMap is used for this process because of the lack of available tools in Collector to accurately measure out and place points onto the map. If users are not able to access a desktop version of ArcMap for this process, they can place points onto the map using Collector by following the instructions in SM 4, **BUT** it is important that users do not push the added points up to the cloud until they have been confirmed in the field as correct transect beginning and end point locations.







Pre-screening of Roadside Plots—Locate the roadside point on the map.




If surveying were to take place from the roadside point, determine in which direction it would take place; either northwest or northeast based off of the road's orientation. Using the *Measure* tool in ArcMap , confirm that there is at least 700 meters of road available for sampling from the roadside point. Confirm that there is at least 6 meters of accessible vegetation on each side of the road for the entire 700 meter length. Assigning 8 transects on both sides of the road using a GIS and good background map will facilitate knowing if the site does not qualify (Figure SM-1.2). If these conditions are met, this roadside point is a candidate for being surveyed.


Remember, the site's actual condition may not match the satellite imagery. There is no substitute for visual confirmation that the site can be surveyed.

Inserting the Transect Lines into a Map—Create two rectangles (10m x 30m & 75m x 30m) to use as templates for creating the transect lines. Creating these rectangles will make the process much more efficient and exact; negating the need to repeatedly re-plot points, check their distances, and have differing length transect lines. The larger rectangle will serve as a template for the transect line, and the smaller rectangle will act as a pre-measured spacer to ensure that the 10m spacing between transects is maintained.

- Zoom to 1:800 scale near the roadside point for easier detail acquisition for these steps.
- Make sure both the *Tools* and *Draw* toolbars are selected.

- i. Select *Customize* > select *Toolbars* > select *Tools* and *Draw* if not already selected.
 - c. Use the *Measure* tool to measure out a vertical line 75m in length by a horizontal line 30m in length; you are measuring out one long and one short side of a rectangle.
 - i. Select the *Measure* tool by clicking on it. A new, small 'Measure' window should appear. Select the dropdown menu next to the  button in the Measure window > select *Distance* > select *Meters*. Do not close the Measure window. Move your cursor to anywhere on the map with sufficient space. Click once to create a start point, drag the cursor straight down, attempting to make the line as vertical as possible. Watch the *Segment* measurement in the Measure window to determine the line's/segment's length. Once the segment is 75m long, click once to create a point, and then create a new 30m long horizontal segment from the end of the 75m segment by dragging the cursor to the right; the 75m segment will remain on the screen. Click once to create an end point once the 30m segment length is reached. Mark the three corners of the rectangle with the corners of Post-it notes placed on your computer's screen. Once the points are marked, double-click on the map to erase the measurement lines.
 - d. Using the Post-it notes on your screen as distance references, draw a rectangle on the map which is 75m x 30m. Change both the rectangle's *Fill Color* to *No Color*, and its *Line Color* to a color which will stand out against the basemap.
 - i. On the *Draw* toolbar, select *Rectangle* from the dropdown menu  . Move your cursor to the start point you marked with the corner of a Post-it note. Click and hold > drag your cursor down to the end point you marked with a Post-it note > release the cursor. You should now have a 75m x 30m rectangle on the screen. Select the *Measure* tool and check that the rectangle's side lengths are correct.
 - ii. The rectangle you created should still be selected; indicated by a dashed line surrounding the rectangle and eight boxes (four each at the rectangle's vertices and line segment midpoints) being visible. If it is not, select it by clicking *Select Elements*  from the *Draw* toolbar, and then click on the rectangle. Using the dropdown menus, change both the rectangle's *Fill Color* to *No Color* , and its *Line Color* to a color which will stand out against the basemap . Unselect the rectangle by clicking on the map outside of it.
 - e. Repeat all 1c and 1d steps to create a second rectangle measuring 10m x 30m. Make sure this rectangle has a different line color than the 75m x 30m rectangle.
 - f. The two rectangles you just created should be treated as the master templates, and should not be used to map the transect lines. Copies of each can be created by selecting the rectangle and then pressing Ctrl + C, and then Ctrl + V. The 75 m x 30 m rectangle will henceforth be known as the 'transect rectangle,' and the 10 m x 30 m rectangle will henceforth be known as the 'spacer rectangle.'
2. Use copies of each of the rectangles to determine both the spacing between transect lines, and transect lines beginning and end points.
 - a. Move a copy of the transect rectangle beside the roadside point. Orient it so that the rectangle has one of the 75-m long sides paralleling the road's orientation at the roadside point, and one of the 30-m long sides of the transect rectangle is perpendicular to the road and in line with the roadside point. Move the rectangle so that the 75-m side is touching the road edge at the starting point.

- i. Move the transect rectangle copy by selecting it > clicking on it and holding it > drag it to the position you want it to be in > release it.
 - ii. Orient the transect rectangle so it is parallel to the road by selecting it > from the *Draw* toolbar click on the *Rotate* button  > click, hold, and rotate the rectangle to the desired orientation by moving your mouse > release the rectangle > click on *Select Elements*.
 - iii. Repeat steps 2i and 2ii until the rectangle is properly oriented.
 - b. Move a copy of the spacer rectangle to the end of the transect rectangle which is not in line with the roadside point. Following steps 2i and 2ii, orient it so that one of the 10m long sides of the rectangle runs parallel to the road. If the transects are being laid on a straight section of road, the 30m sides of the transect and spacer rectangle(s) will touch;. The two rectangles will either not touch, or overlap, if this part of the road is curved. The spacer rectangle ensures that there will be at least 10m of space/road length between the end point of one transect and the beginning point of another.
 - c. Repeat steps 2a and 2b until there are eight transect rectangles, with spacer rectangles in between them, on both sides of the road.
 - i. If necessary, a transect rectangle's width can be adjusted down from 30m to whatever distance from the roadside a stratum change occurs; there must be a minimum of 6m of vegetation from the roadside.
 - ii. Depending upon both the degree of the curvature of the road, and any unavoidable transect impediments (buildings, different strata for a section of roadside, etc.), transects' 1 and 16 positions will most likely not mirror each other from opposite sides of the road as in Figure SM-1.2. For example, on a curved road, the eight transects on the inside of the curve will extend farther down the road than those on the outside of the curve.
3. Add the transect lines to the map, mark the beginning and end points of the transects, and delete the template rectangles.
- a. Visually confirm that the rectangles are the proper distance from each other, using the measurement tool if necessary, and are oriented in the proper direction.
 - i. I suggest saving a copy of the map with just the template rectangles on it. In the event measurements are off and the transect line positions somehow need to be changed, it may be easier and more exact to move the rectangles and replot the transect lines than to move the lines.
 - b. Select *Line*  from the *Draw* toolbar. Starting with the transect rectangle for Transect 1 (see Figure SOP-1.2 for reference), click in the corner of the rectangle closest to the road and move your cursor to the diagonally opposite corner of the rectangle, thus separating the transect rectangle into two right triangles; you are creating a line that is heading away from the road and against traffic. Once your cursor is over the diagonally opposite corner from your starting corner, double click to create the transect line.
 - i. You can make the transect line thicker or a different color by clicking *Select Elements*, and then double clicking on the line. This will open the line's formatting window.
 - c. Place a white point (white because white flags will be used in the field) at the beginning and end of the transect line.
 - i. To place a point, select *Marker*  on the *Draw* toolbar > place your cursor over the location you want the point > click once.

- ii. To change the point's size, shape, or color, click *Select Elements*, and then double click on the point. This will open the point's formatting window.
- d. For the transect rectangles for Transects 1, 8, 9, & 16, the beginning and ending transect vertices need to be marked by pink points (pink because pink flags will be used in the field). These points will indicate the beginning and end of the area comprised by the eight transects on each side of the road. There should be four pink points inserted into the map on each side of the road. See SOP 1 and Figure SM-1.2 for a visual reference and further explanation.
- e. Once the transect line is inserted, the start and end points of the line are marked, and the corners are marked by pink points, if necessary, delete the transect rectangle by selecting it and pressing delete.
- f. Repeat 3e for each of the fifteen remaining transect rectangles.
- g. Once all transect lines have been created, delete all of the spacer rectangles.
- h. If you feel it is necessary, label each of the transects at their starting point by selecting *Text*  from the *Draw* toolbar > clicking in the approximate location of the place where you'd like the text to be > typing the text > clicking outside of the text box. Use the *Draw* toolbar to edit the text. The text can be moved around the map in the same way the rectangles were.

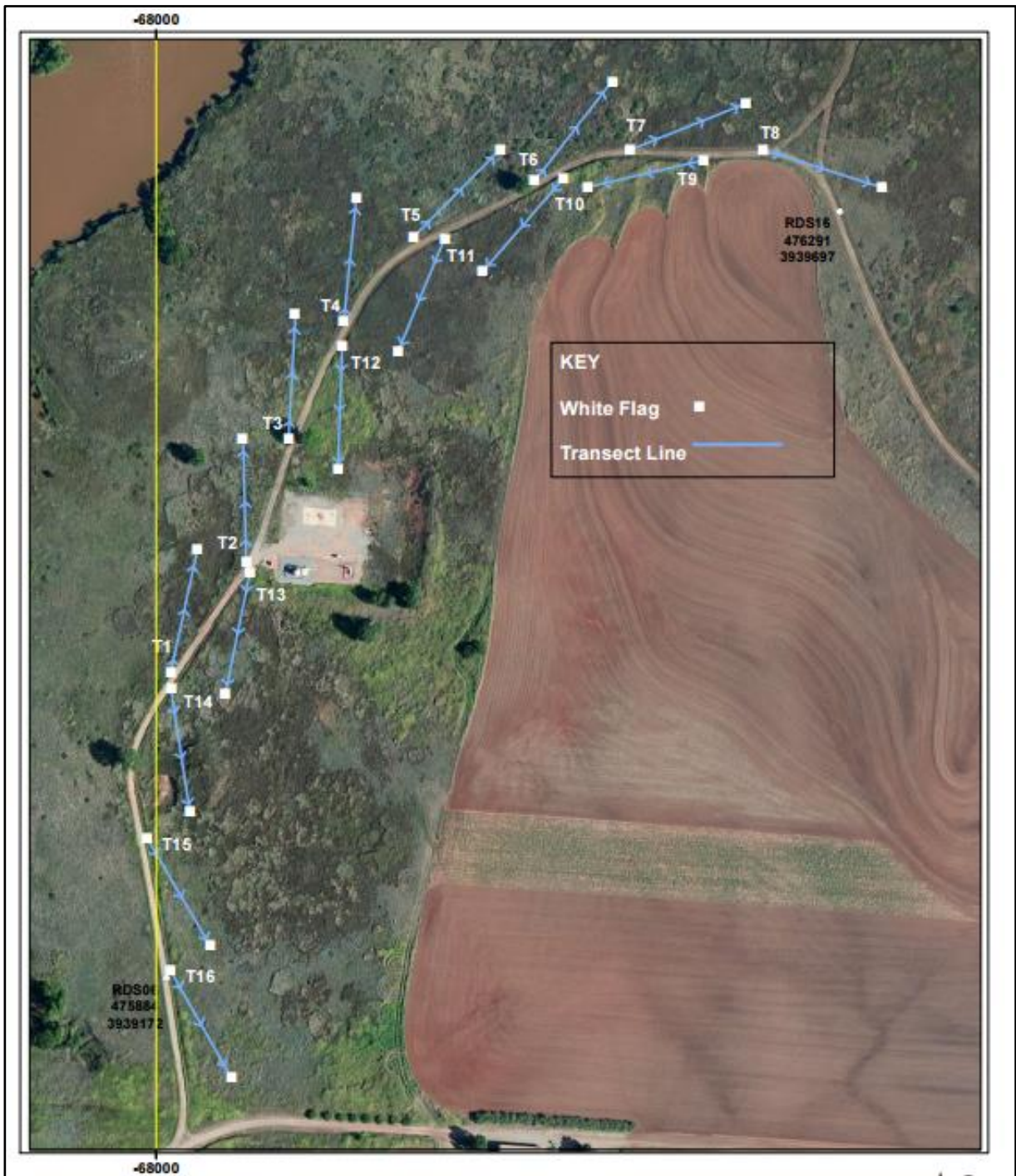


Figure SM-1.2. Example results of pre-screening potential roadside (RDS) plot by working in 16 75-m diagonal transects in a GIS before conducting site visits.